REMARKS

This is a full and timely response to the final Office Action of April 24, 2002 and the Advisory Action of August 27, 2002. Reconsideration and allowance of the application and all presently pending claims are respectfully requested.

Upon entry of this Response, claims 1-21 and 23-68 are pending in this application. Claims 1, 21, 34, and 36 are directly amended herein and claims 65-68 have been newly added. Claims 1, 2, 7-10, 12-13, 21, 23-25, 27-28, 34, 36, 43-48 and 61-64 presently stand rejected under 35 U.S.C. §102(b) as being anticipated by *Yanagihara et al.* (U.S. Patent Number 5,523,623). In addition, claims 3-6, 6-11, 14-20, 26, 29-33, 35, and 37-42 presently stand rejected under 35 U.S.C. §102(e) as being unpatentable over *Yagura et al.* (U.S. Patent Number 6,188,137). Further, claims 1, 7 and 21 presently stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The Office alleges that the alternative limitations recited in claims, 1, 7 and 21 are unacceptable and that an acceptable alternative expression would be a Markush group.

Response to §112, Second Paragraph Rejections

Claims 1, 7 and 21 have been rejected as being indefinite. The Office suggests that the Applicant re-write the claim in a Markush group. Applicant respectfully traverses, and directs the Office's attention to M.P.E.P. §2173.05 (h), which reads: "Alternative expressions are permitted if they present no uncertainty or ambiguity with respect to the question of scope or clarity of the claims. *One acceptable form of alternative expression...* is commonly referred to as a Markush group...." (Emphasis added.) Thus, while a Markush group is an acceptable expression in claim language, Applicants are not limited to that exact expression, and may use alternative expressions

as long as the claim language and scope are certain and unambiguous. Applicant believes that an exemplary phrase "X chosen from A, B, and C" is clear and unambiguous, and thus respectfully requests that the rejection of claims 1, 7 and 21 be withdrawn.

Response to §102 and §103 Rejections

For a proper rejection of a claim under 35 U.S.C. §102, the cited reference must disclose all elements/features/steps of the claim. See, *e.g.*, *E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 7 USPQ2d 1129 (Fed. Cir. 1988). Further, in order for a claim to be properly rejected under 35 U.S.C. §103, the combined teachings of the prior art references must suggest all features of the claimed invention to one of ordinary skill in the art. See, *e.g.*, *In Re Dow Chemical*, 5 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1988), and *In re Keller*, 208 U.S.P.Q. 871, 881 (C.C.P.A. 1981). In addition, "[t]he PTO has the burden under section 103 to establish a *prima facie* case of obviousness." *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988) (Citations omitted).

Response to §102 Rejections

Claims 1, 2, 7-10, 12-13, 21, 23-25, 27-28, 34, 36, 43-48 and 61-64 have been rejected under 35 U.S.C. §102(b) as allegedly anticipated by *Yanagihara et al.* Independent claims 1, 21, 34 and 36 each have been amended to claim that "additional overlayers of conductive metal are not necessary in the ohmic contact."

The independent claims are allowable for at least the reason that *Yanagihara et al.* do not disclose, teach, or suggest these features, as well as other aspects of the independent claims. More

specifically, the ohmic contact of *Yanagihara et al.* includes a titanium and/or platinum overlayer. *See* column 5, lines 36-41 and column 6, lines 20-22 and FIGS. 2B and 2D. The present invention, in contrast, has a refractory layer that

> improves (*i.e.*, reduces) contact sheet resistance and eliminates the need for deposition of a low-resistivity, high-conductivity gold overlayer. Prior art techniques typically include depositing a low sheet resistance gold overlayer on the contact system to reduce the sheet resistance of the contact.... Alternatively, this low sheet resistance overlayer may comprise any one or more of a variety of different metals and/or material having such properties of low-resistivity and high-conductivity in the described application. For ease of discussion, "gold" will be used to represent all metals and/or materials having such desirable electrical properties.

See instant specification, page 7, lines 1-11.

Because the present application has eliminated the need for the titanium, platinum, or gold overlayer that is used by *Yanagihara et al.*, processing time may be shortened by reducing the number of metallization layers in the contact structure, and material cost may be reduced by eliminating and/or minimizing the use of precious metals, without sacrificing device performance or functionality. Thus, for at least this reason, the ohmic contact of *Yanagihara et al.* does not read on independent claims 1, 21, 34 and 36.

Additionally, it should be noted that the ohmic contact of *Yanagihara et al.* has three metal layers that are heated to approximately 400°C to form an *alloy*. The present invention, however, includes a reactive layer and a refractory layer that, as claimed in independent claims, are distinct layers, and not merely metals that are heated to comprise an alloy.

Further, ohmic contact of *Yanagihara et al.* requires a diffusion layer that is an alloy of Ni, Ti, and Pt, embedded in P-type GaAs layer. *See* column 7, lines 36-53. The present invention, in contrast, needs no diffusion layer because the reactive layer, as claimed in the independent claims, is deposited on at least a portion of a compound semi-conductor layer. The amount of material

deposited "is sufficient to create low contact resistance at the interface of reactive layer 301 and cap layer 107. In accordance with one embodiment of the present invention ... the ohmic contact is optimized such that the deposited nickel reacts with the cap layer 107 and the resultant alloy interfacial layer (not shown) reaches equilibrium during manufacture. If equilibrium is reached, the potential for further chemical reaction between the nickel metal and the compound semi-conductor material of cap layer 107 is substantially or completely eliminated and 'punch through' caused by a reactive diffusion is minimized." *See* instant specification at page 6, lines 5-11. Thus, for these reasons as well, the ohmic contact of *Yanagihara et al.* does not read on the ohmic contact of the present invention as claimed in independent claims 1, 21 and 34. Applicant therefore respectfully requests that the rejection be withdrawn.

If the independent claims 1, 21, 34 and 36 are allowable over the prior art of record, then their dependent claims 2, 7-10, 12-13, 23-25, 27-28, 43-48 and 61-64 are also allowable as a matter of law, because these dependent claims contain all features/elements/steps of their respective independent claims. Additionally and not withstanding the forgoing reasons for the allowability of the independent claims, these dependent claims recite further features/steps and/or combinations of features/steps that are patentably distinct from the prior art of record. Hence, there are other reasons why these dependent claims are allowable. For example, the ohmic contact of *Yanagihara et al.* is formed on a P+ GaAs substate. In contrast, claims 2-6 and 37-41 claim other types of substrates on which the ohmic contact of the present invention is formed. Additionally, newly added claims 65-68 claim that the ohmic contact of the present invention is formed on a N+ InGaAs semi-conductor layer. Thus, the semiconductor device of *Yanagihara et al.* does not read on at least these

dependent claims. Applicant respectfully requests, therefore, that the rejection of all claims 1, 2, 7-10, 12-13, 21, 23-25, 27-28, 34, 36, 43-48 and 61-64 be withdrawn.

Response to §103 Rejections

Claims 3-6, 11, 14-20, 26, 29-33, 35 and 37-42 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over *Yanagihara et al.* in view of *Yagura et al.* (U.S. Patent No. 6,188,137). Each of these claims are dependent upon independent claims 1, 21, 34 and 36, respectively, and therefore contain all the limitations/features of those claims. As noted above, the independent claims are believed to be allowable over the prior art of record, and thus these dependent claims should be allowable as well. Applicant therefore respectfully requests that the rejections of these dependent claims be withdrawn.

Additionally and not withstanding the allowability of the independent claims, these dependent claims recite further features/steps and/or combinations of features/steps which are patentable over *Yanagihara et al.* in view of *Yagura et al.* In particular, the Office alleges that many of the limitations would be "obvious to an artisan at the time the invention was made" and the Office "takes an official notice" that certain features are "a well-known practice in the field and considered an art recognized equivalence." The attention of the Examiner is directed to a recent court decision by the United States Court of Appeals, Federal Circuit, *In re Lee*, 277 F.3d 1338 (January 18, 2002). In this case, the court held that analysis by the Board of Patent Appeals and Interferences ("Board") did not comport with either legal requirements for determination of obviousness or requirements or the Administrative Procedure Act (APA). In particular, the court stated that the "question of motivation is material to patentability, and could not be resolved on

subjective belief and unknown authority. It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to '[use] that which the inventor taught against its teacher.'" *See* 277 F.3d at 1344. Additionally, the court held that "deficiencies of the cited references cannot be remedied by the Board's general conclusions about what is 'basic knowledge' or 'common sense.'" *See Id.* Thus, when Applicants have clearly demonstrated unexpected benefits and results not achieved by prior art devices, by using a different material or combinations of material, or percentages of material, the Office should clearly define support for rejections of such features and not rely on the general state of the art. For this reason as well, Applicant respectfully requests that the rejection of the dependent claims be withdrawn.

Claims 49-50 have been rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over *Yanagihara et al.* and *Yagura et al.*, and further in view of *Bernhardt et al.* (U.S. Patent No. 5,583,355). As noted above, these dependent claims are dependent upon independent claims which Applicant believes to be allowable. For at least this reason, Applicant respectfully requests that the rejection be withdrawn.

New Claims

In addition, claims 65-68 are newly added to further define the invention, and because they depend from independent claims 1, 21, 34 and 36, respectively, Applicant believes them to be allowable for at least the same or similar reasons that claims 1, 21, 34 and 36 are allowable.

CONCLUSION

Applicant respectfully requests that this application and all presently pending claims be allowed to issue. If the Examiner has any questions or comments regarding Applicant's response, the Examiner is encouraged to telephone Applicant's undersigned counsel.

Respectfully submitted ,

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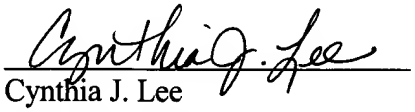
By: 
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ANNOTATED VERSION OF MODIFIED CLAIMS TO SHOW CHANGES MADE

Amend the following pending claims by deleting that language which is enclosed within brackets ("[ ]") and by inserting that language which is underlined ("___").

1. A method for forming an ohmic contact on a semiconductor layer comprising:

(a) depositing a reactive layer comprising at least one electrically conductive material on at least a portion of a compound semiconductor layer, wherein the at least one electrically conductive material is chosen from nickel, ruthenium, vanadium, gold, and cobalt; and

(b) depositing a refractory layer comprising electrically conductive material on the reactive layer, wherein said refractory layer is substantially free of gold, and

wherein additional overlayers of conductive metal are not necessary in the ohmic contact.

21. An ohmic contact to a compound semiconductor layer comprising:

(a) a reactive layer comprising at least one electrically conductive material, wherein the at least one electrically conductive material is [chose] chosen from nickel, ruthenium, vanadium, gold, and cobalt, and

(b) a refractory layer, wherein said refractory layer is substantially free of gold, and

wherein additional overlayers of conductive metal are not necessary in the ohmic contact.

34. An ohmic contact to a compound semiconductor layer comprising:

(a) a reactive layer, said reactive layer is nickel; and

(b) a refractory layer, said refractory layer is titanium,

wherein said refractory layer is substantially free of gold, and

wherein additional overlayers of conductive metal are not necessary in the ohmic contact.

36. A method for forming an ohmic contact on a compound semiconductor layer of a semiconductor device comprising:

(a) depositing a reactive layer on at least a portion of a compound semiconductor layer of a semiconductor device, wherein the reactive layer is nickel and an adhesive element;

(b) depositing a refractory layer on said reactive layer, said refractory layer is titanium,

wherein said refractory layer is substantially free of gold, and

wherein additional overlayers of conductive metal are not necessary in the ohmic contact.